



Queensland University of Technology
Brisbane Australia

This is the author's version of a work that was submitted/accepted for publication in the following source:

Wickramage, Chathurika, Fidge, Colin, Sahama, Tony, Daly, Angela, & Wong, Roy
(2017)

Preserving privacy through log analysis in health information systems. In *Data Privacy Asia Pacific Conference 2017*, 12 July 2017, Sydney, NSW. (Unpublished)

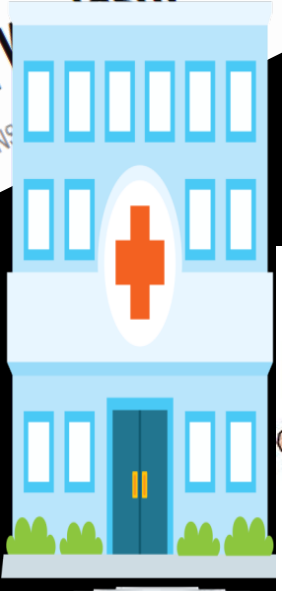
This file was downloaded from: <https://eprints.qut.edu.au/109843/>

© Copyright 2017 [please consult the author]

Notice: *Changes introduced as a result of publishing processes such as copy-editing and formatting may not be reflected in this document. For a definitive version of this work, please refer to the published source:*

Preserving Privacy through Log Analysis in Health Information Systems

Indian victim of privacy breach at hospital
Now Available on the mid-day iOS App, Download Now



Chathurika Wickramage
Queensland University of Technology

Data Breaches in Healthcare

- Australians' Medicare details online and been sold – July, 2017
- Encrypted private medical records released – August, 2016



Background

Insider threat



Break the glass approach



Need for Information Accountability in Healthcare

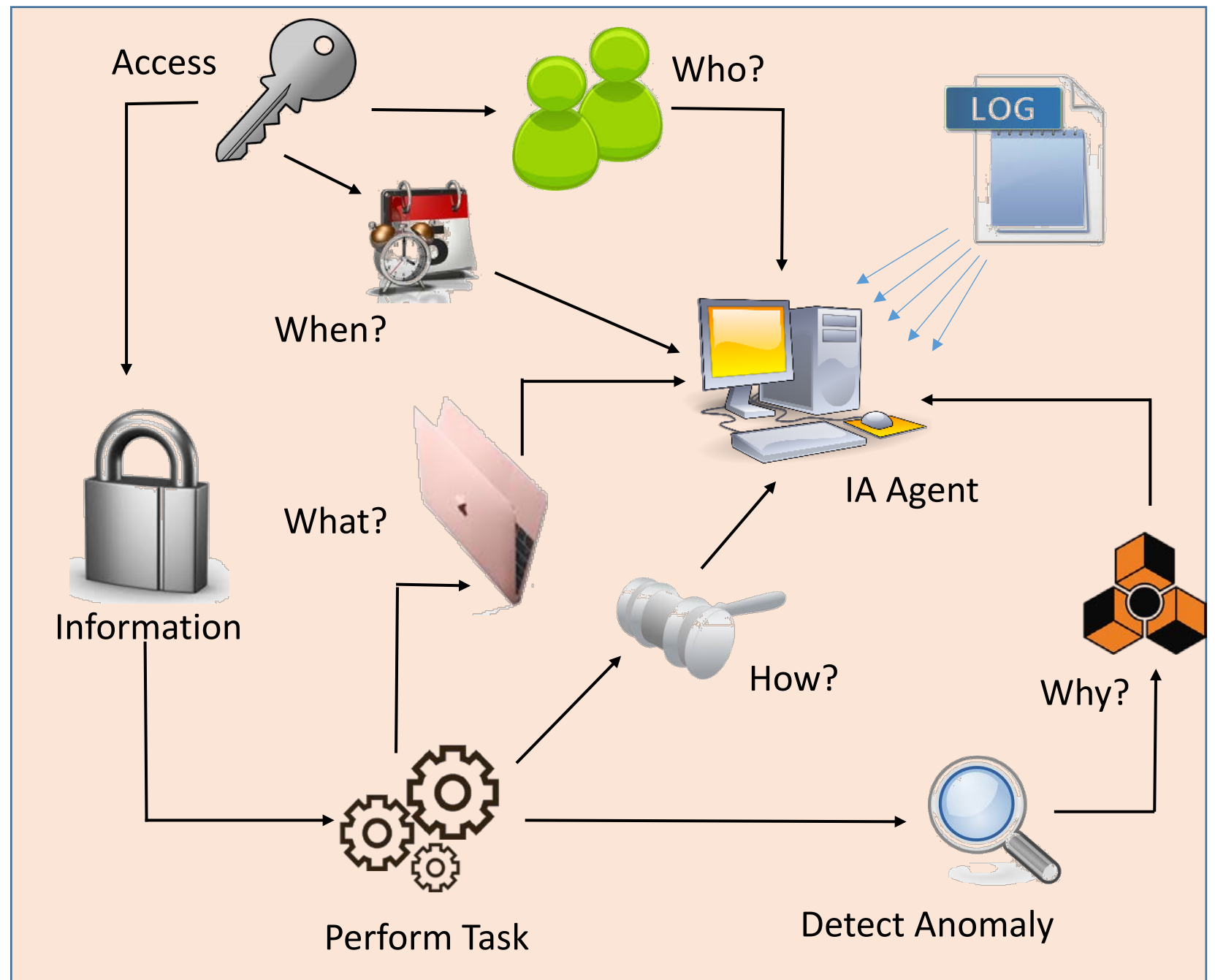
Information tampering



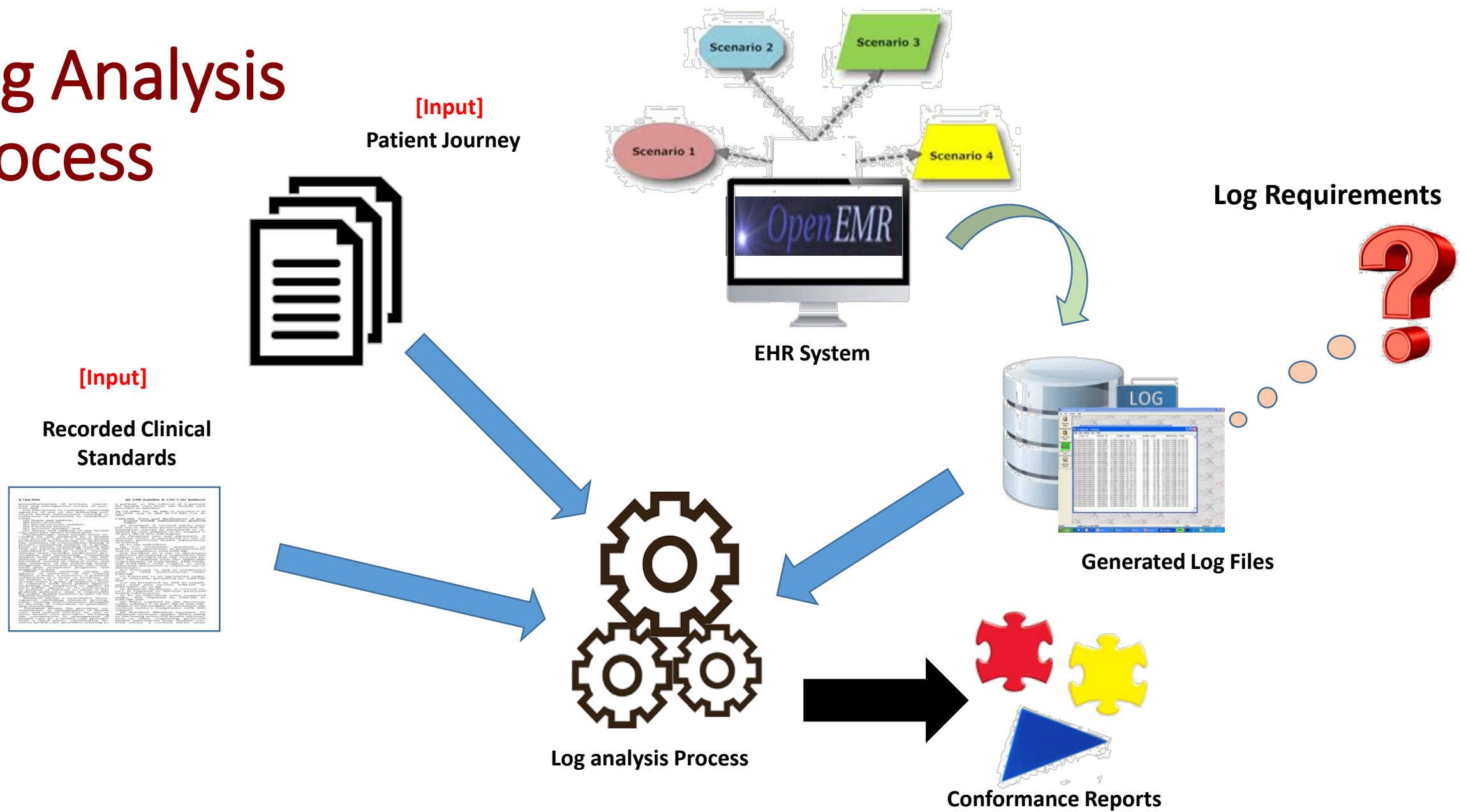
Information unavailability



Information Accountability Framework



Log Analysis Process



Legal framework on health data privacy

- In Australia: both federal and state & territory legislation pertinent to health data and health data breaches
- Provisions in these laws which make unauthorised access to (health) data illegal
- Similar laws exist in other countries eg HIPAA in the US, the new General Data Protection Regulation in the EU
- Here, we use HIPAA as an example of legislative requirements

Exemplary health information disclosures

HollywoodLife.com
Kim Kardashian

BREAKING NEWS!

Kim Kardashian victim of privacy breach at hospital

By IANS | Posted 15-Jul-2013

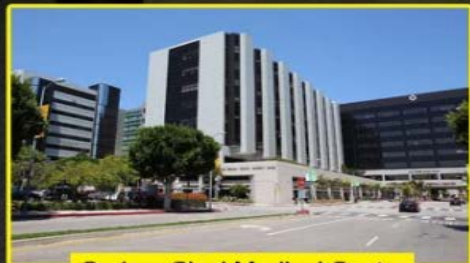
Now Available on the mid-day iOS App, Download N

Kim Kardashian can't get any privacy, no matter how hard she tries. Reportedly Cedars-Sinai Medical Center, where **Kimmy gave birth** to **North West** on June 15, isn't even a safe place.

Kim Kardashian & North West: Hospital Fires Workers

Six hospital workers have been fired from the hospital after "inappropriately accessing" Kim and other patients' records, according to the *Los Angeles Times*.

The privacy breaches occurred between June 18 and June 24, Cedars-Sinai said in an official statement. Kim was checked into the hospital on June 15 and left about a week later. The hospital workers in question reportedly accessed records for reasons not related to the patients' health, which is what makes their offenses fireable.



Cedars-Sinai Medical Center

Exemplary health information disclosures

HIPAA Rule: “Covered entities must obtain patient authorization before they use or disclose PHI for marketing purposes. Under the Privacy Rule, ‘marketing’ means communicating about a product or service in a way that encourages a recipient to purchase or use the product or service. Whether a communication is ‘marketing’ often depends on whether the covered entity is paid in exchange for encouraging a product or service. If a covered entity is receiving payment to market a product or service, that must be included in the authorization”.

Exemplary health information disclosures

HIPAA Rule: “Covered entities must not use or disclose PHI for marketing purposes, such as communicating about a product or service, or for the purchase or use of the product or service, unless the use or disclosure often depends on whether the covered entity has provided the product or service. If a covered entity discloses PHI for a service, that must be included in the authorization”.

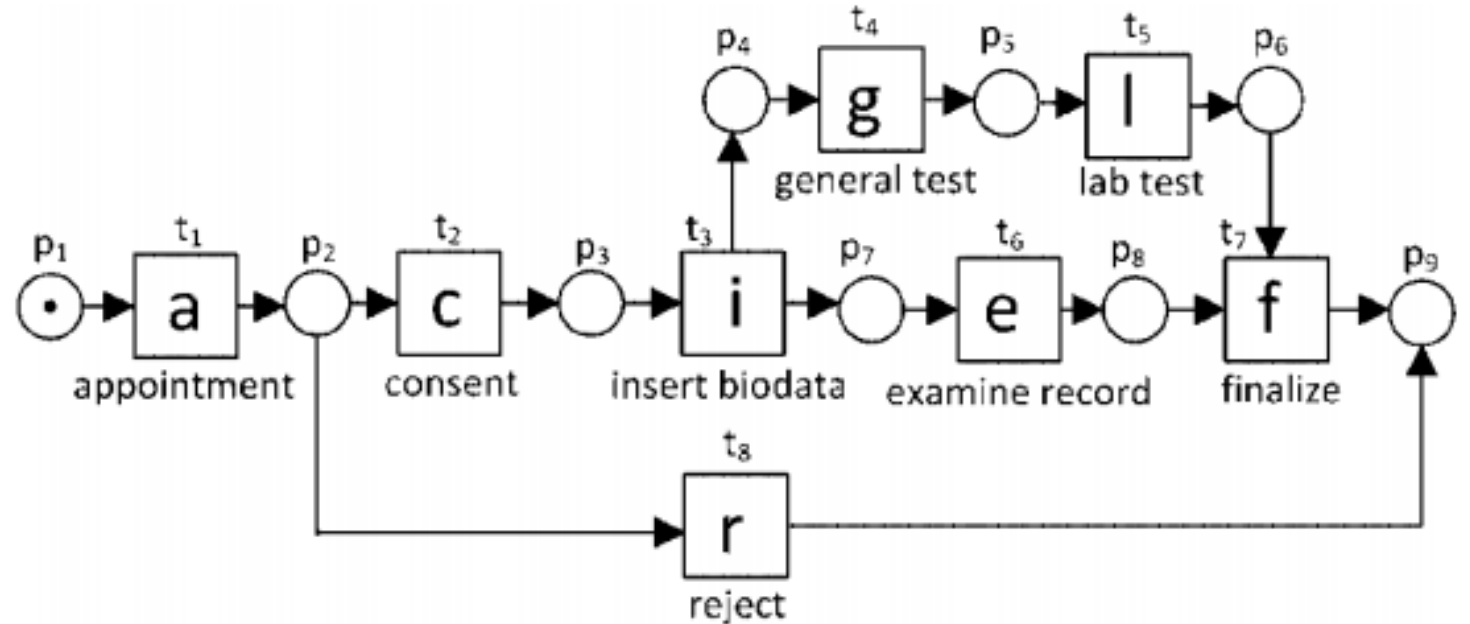
$$\begin{aligned} &\forall p1, p2, m, u, q, t. \\ &(\text{send}(p1, p2, m) \wedge \\ &\text{inrole}(p2, \text{law-enforcement}) \wedge \\ &\text{tagged}(m, q, t, u) \wedge \\ &\text{attr_in}(t, \text{phi})) \\ &\supset (\text{purp_in}(u, \text{id-criminal})) \\ &\quad \wedge \exists m'. \Diamond \text{state}(q, m') \wedge \text{is-admission-of-crime}(m') \\ &\quad \wedge \text{believes-crime-caused-serious-harm}(p1, q, m') \end{aligned}$$

Exemplary health information disclosures

Case Scenario: Patient P has been admitted for treatments for a heart attack and has been released from the hospital. Doctor Dx has been granted access to the full details of Patient P's medical history in the critical time period of Patient P where earlier, Doctor Dx was not allowed to access all the details of Patient P. P, being a celebrity, media is interested in knowing much information about the incident. A media representative has motivated Dx to provide P's full health information for a considerable cost. The media representative makes a lucrative deal with Dr. Dx to have the full health information of Patient P. Dx accesses the patient's EHR, including mental health information, pretending it is an emergency situation in order to collect necessary information for the media representative.

Exemplary health information disclosures

Case Scenario: Patient P has been admitted for treatments for a heart attack and has been released from the hospital. Doctor Dx has been granted access to the full details of Patient P's medical history in the critical time to access all the details of Patient P's information about the incident. A health information for a considerable Dr. Dx to have the full health information, pretend information for the media representative.



Patient: None

[Calendar](#)
[Message and Reminder Center](#)
[Logs Viewer](#)

Date	Event	Category	User	Certificate User	Group	PatientID	Success	Comments
2017-03-19 21:16:28	login	login	Dy		Default		1	success: 127.0.0.1
2017-03-19 21:19:58	view	view	Dy		Default		1	34
2017-03-19 21:20:13	logout	logout	Dv		Default		1	success
2017-03-19 21:20:21	login	login	emergency		Default		1	success: 127.0.0.1
2017-03-19 21:20:29	view	view	emergency		Default		1	34
2017-03-19 21:20:57	logout	logout	emergency		Default		1	success
2017-03-19 21:21:47	login	login	admin		Default		1	success: 127.0.0.1
2017-03-19 23:25:29	logout	logout	admin		Default		1	success
2017-03-19 23:25:33	login	login	Dy		Default		1	success: 127.0.0.1
2017-03-19 23:25:47	view	view	Dy		Default		1	8
2017-03-19 23:25:58	logout	logout	Dy		Default		1	success
2017-03-19 23:26:06	login	login	emergency		Default		1	success: 127.0.0.1
2017-03-19 23:26:13	view	view	emergency		Default		1	8
2017-03-19 23:26:20	logout	logout	emergency		Default		1	success
2017-03-19 23:47:52	login	login	emergency		Default		1	success: 127.0.0.1
2017-03-19 23:47:58	view	view	emergency		Default		1	8
2017-03-19 23:57:16	logout	logout	emergency		Default		1	success
2017-03-19 23:57:21	login	login	admin		Default		1	success: 127.0.0.1

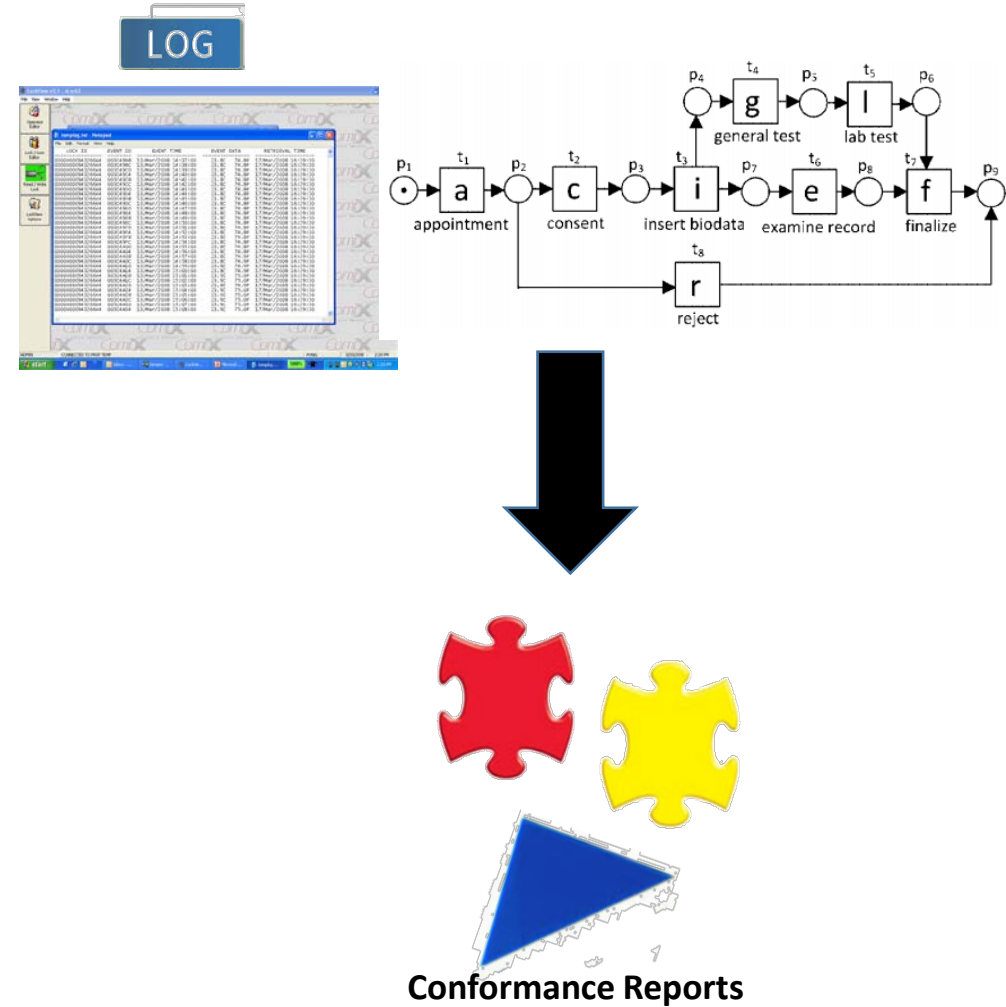
Patient: None

Calendar Message and Reminder Center Logs Viewer

Date	Event	Category	User	Certificate User	Group	PatientID	Success	Comments
2017-03-19 21:16:28	login	login	Dy		Default		1	success: 127.0.0.1
2017-03-19 21:19:58	view	view	Dy		Default		1	34
2017-03-19 21:20:13	logout	logout	Dv		Default		1	success
2017-03-19 21:20:21	login	login	emergency		Default		1	success: 127.0.0.1
2017-03-19 21:20:29	view	view	emergency		Default		1	34
2017-03-19 21:20:57	logout	logout	emergency		Default		1	success
2017-03-19 21:21:06	login	login	emergency		Default		1	success: 127.0.0.1
2017-03-19 21:21:14	view	view	emergency		Default		1	8
2017-03-19 21:21:20	logout	logout	emergency		Default		1	success
2017-03-19 21:21:52	login	login	emergency		Default		1	success: 127.0.0.1
2017-03-19 21:21:58	view	view	emergency		Default		1	8
2017-03-19 21:22:16	logout	logout	emergency		Default		1	success
2017-03-19 21:22:21	login	login	admin		Default		1	success: 127.0.0.1

- What events need to be logged?
- What should be included when logging such events?

Conformance Checking



Summary

- We are proposing **log requirements and audit processes** that facilitate evidence in HHS to improve patients' information privacy in accordance with legal requirements.



Contributors

- Professor Colin Fidge, Faculty of Science, Queensland University of Technology, Australia
- Associate Professor Tony Sahama, The University of the South Pacific, Fiji
- Dr. Chun Ouyang, Faculty of Science, Queensland University of Technology, Australia
- Dr. Angela Daly, Faculty of Law, Queensland University of Technology, Australia
- Ms. Chathurika Wickramage, Faculty of Science, Queensland University of Technology, Australia
- Mr. Roy Wong, Faculty of Science, Queensland University of Technology, Australia
- **Acknowledgement:** ACHLR Funds, Queensland University of Technology

Thank You!